Lighting Your Way Home

Finding the Optimal Path to the MBTA

Sarah Ferry, Alex O'Connor, Dimitri Makrigiorgos

Project Motivation

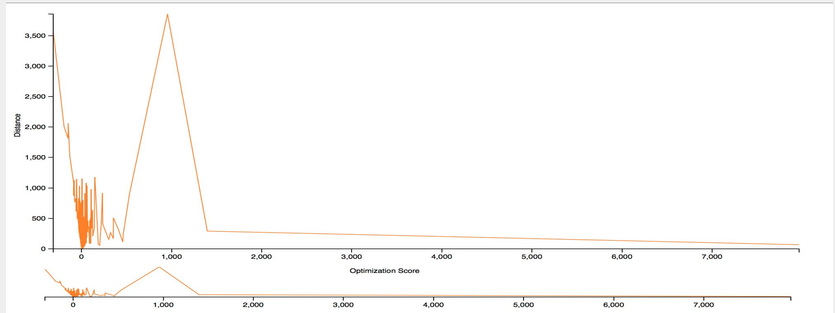
- Getting home in Boston after going to an establishment that serves alcohol can be dangerous
- We mapped the safest routes from every location in Boston with an alcohol license to an optimal MBTA stop based on how well lit the path was
- Our goal was to take a step towards helping citizens get home safe

Data & Transformations

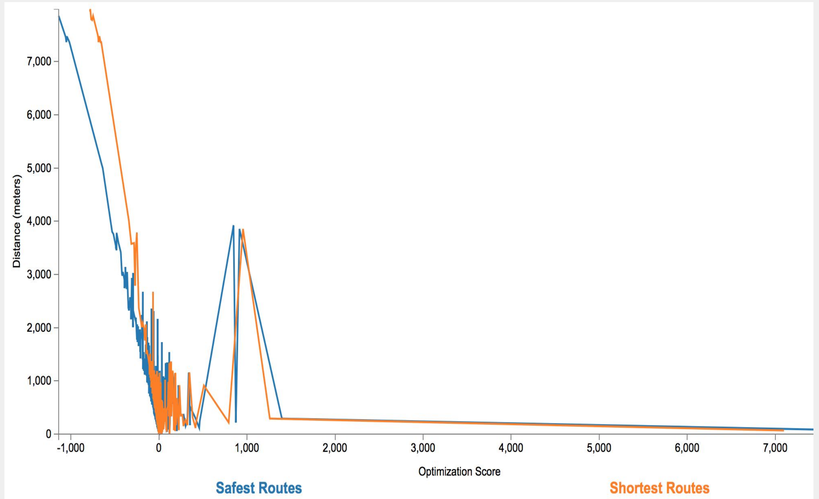
- We used data from four sources:
  - Section 12 Alcohol Licenses
  - Streetlight Locations
  - MBTA V3 API developer portal
  - OpenStreetMap
- Found the three closest MBTA stops to each alcohol license establishment
- Incorporated the streetlight dataset to produce a dataset that contained each alcohol establishment, the three nearest MBTA stops, and all of the streetlights within the radius

Statistical Analysis

- We tested to see if there were more streetlights on average at the start and end nodes of a route than at the middle nodes in a route ($\alpha = .01$)
- H_0: $\mu(\text{start} + \text{end}) - \mu(\text{middle}) > 0$
- H_A: $\mu(\text{start} + \text{end}) - \mu(\text{middle}) <= 0$
- Our *p* value was .9998, therefore we concluded that there were more streetlights on average at the start and end nodes of a route than at the middle nodes in a route
- Separately, the average number of nodes in a route was 3.9375, & the average distance of a route was 525.008 meters



Distance vs. Optimization Score for Each Optimal Route



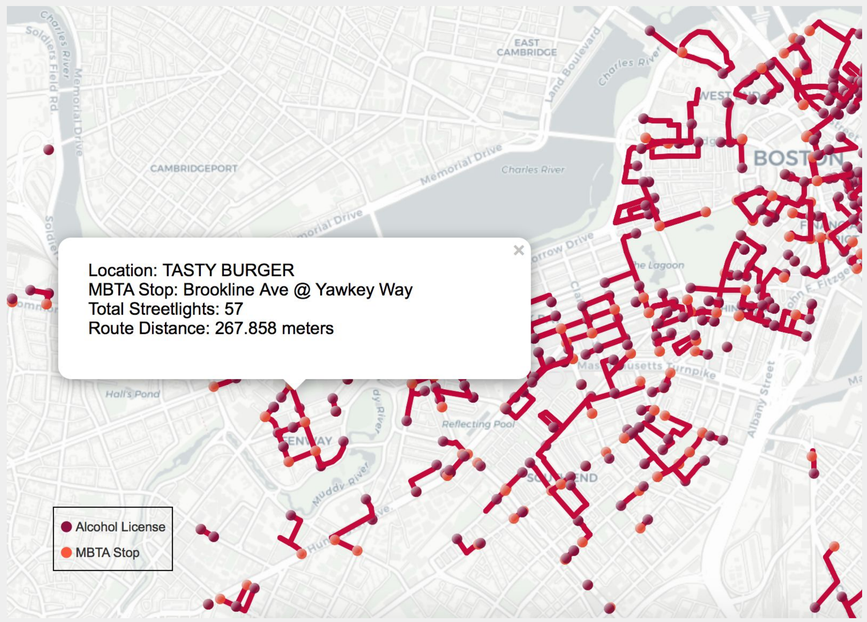
Distance vs. Optimization Score for Safest and Shortest Routes

Tools

- OpenStreetMap
- OSMnx
- NetworkX
- d3
- geoql
- SciPy & StatsModels
- Folium

Optimization

- Find the optimal route from an alcohol establishment to an MBTA stop
- Generated a driving map of the city of Boston using the OpenStreetMap API OSMnx and found the closest node on this map for each of the alcohol establishments, MBTA stops, and streetlights
- Calculated both shortest paths and safest paths
- Determined the safest path to be the path that includes the node with the most streetlights
- Performed an optimization technique that scored all six of the paths
- Based on a number of factors including route distance (*d*), number of streetlights (*n*), and variance of streetlights (*v*)
- Shortest path score =.4*v* + .4*n* - .1*d*
- Safest path score =.45*v* + .4*n* - .15*d*



Conclusion and Future Direction

- By gathering this data and creating these visualizations we hope to help decrease the risk of getting home after consuming alcohol
- This will not eliminate all risk associated with drinking and getting home, but we believe this is a step in the right direction towards making Boston a safer neighborhood
- With more time, we would improve the visualizations such that a user would be able to enter a specific establishment and the MBTA stop and have the path generated for them dynamically
- We also would create a graph with sidewalk data instead of street data so that we could calculate walking directions instead of directions along roads
- Lastly, we would include other features to help people get home safe, possibly incorporating information such as using Uber